Notice of Allowability	Application No.	Applicant(s)	
	10/797,650	TOMITA, AKI	
	Examiner	Art Unit	
	Thanh D. Vo	2189	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the After Final Argument filed on May 15, 2006 and the phone interview on June 12, 2006*.

2. ☒ The allowed claim(s) is/are *1-5,7-16 and 18-20*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

1. This Office Action is responsive to the After Final filed on May 15, 2006. Claims 6 and 17 have been cancelled. Claims 1-5, 7, 12-16, and 18-19 have been amended. Claims 1-5, 7-16, 18-20 are in condition for allowance.

EXAMINER'S AMENDMENT

2. An extension of time under 37 CFR 1.136(a) is required in order to make an examiner's amendment which places this application in condition for allowance. During a telephone conversation conducted on June 12, 2006 with Mr. George B. F. Yee requested an extension of time for 1 MONTH(S) and authorized the Director to charge Deposit Account No. 20-1430 the required fee of $120.00 for this extension and authorized the following examiner's amendment. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

3. The application has been amended as follows:

1. (Currently Amended) A data I/O system comprising:

a plurality of storage devices; and

a controller which controls said storage devices, wherein said controller includes:

a read/write unit, responsive to the subsequent receipt of a read request and a write request, for reading data stored in said storage devices and writing data in said storage devices;

a logical volume management unit configured to map between a logical image of the data storage of a host processor (logical volume) and an actual space in said storage devices;

a volume management unit configured to manage an active primary production volume (P-VOL) and a secondary mirror volume (S-VOL) group including multiple S-VOLS created as mirror images of said primary volume; and

an S-VOL restoring unit configured to restore the data of a first S-VOL belonging to the S-VOL group with the data of a second S-VOL belonging to the S-VOL group depending on the type of an error that happens in the first S-VOL;

wherein said controller further includes:

an access management unit configured to render at least one of said S-VOLs belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL and rendering at least one of said S-VOLs belonging to an S-VOL group read-and-writable as at least one Read-and-Writable (RW) S-VOL; and

an increments management unit configured to store updates that have occurred in a Read-and-Writable (RW) S-VOL since a P-VOL and the RW S-VOL were separated in an increments-volume,

wherein said S-VOL restoring unit recovers a RW S-VOL belonging to the S-VOL group by replacing the RW S-VOL with the at least one Read-only (RO) S-VOL that has

been updated by data of the increments-volume of the RW S-VOL as an error happens in the RW S-VOL.

2. (Currently amended) A data I/O system according to claim 1, ~~wherein said controller further includes an access management unit configured to render at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL,~~ wherein said S-VOL restoring unit recovers an S-VOL belonging to the S-VOL group by copying data of the at least one Read-only (RO) S-VOL to said S-VOL as an error happens in said S-VOL.

3. (Currently amended) A data I/O system according to claim 1, ~~wherein said controller includes an access management unit configured to render at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL,~~ wherein said S-VOL restoring unit recovers an S-VOL belonging to the S-VOL group by replacing the S-VOL with said at least one Read-only (RO) S-VOL as an error happens in said S-VOL.

4. (Currently amended) A data I/O system according to claim 1, wherein said controller further includes:

~~an access management unit configured to render at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL; and~~

a monitoring unit configured to monitor frequencies of accesses to said at least one Read-only (RO) S-VOL, wherein said S-VOL restoring unit restores the data of an S-VOL belonging to the S-VOL group by copying the data of said at least one RO S-VOL with the lowest access frequency as an error happens in said S-VOL.

5. (Currently amended) A data I/O system according to claim 1, wherein said controller further includes:

~~an access management unit configured to render at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL; and~~

a monitoring unit configured to monitor frequencies of accesses to the at least one Read-only (RO) S-VOL,

wherein said S-VOL restoring unit recovers an S-VOL belonging to the S-VOL group by replacing the S-VOL with said at least one RO S-VOL with the lowest access frequency as an error happens in said S-VOL.

6. (Cancelled)

7. (Currently amended) A data I/O system according to claim 1, wherein said controller further includes:

~~an access management unit configured to render at least one of said S-VOLs belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL and rendering at least one of said S-VOLS belonging to an S-VOL group read-and-writable as at least one Read-and-Writable (RW) S-VOL;~~

a monitoring unit configured to monitor frequencies accesses to the at least one Read-only (RO) S-VOL; and

~~an increments management unit configured to store updates that have occurred in a Read-and-Writable (RW) S-VOL since a P-VOL and the RW S-VOL were separated in an increments-volume,~~ wherein said S-VOL restoring unit recovers a RW S-VOL belonging to the S-VOL group by replacing the RW S-VOL with the at least one RO S-VOL with the lowest access frequency that has updated by data of the increments-volume of the RW S-VOL as an error happens in the RW S-VOL.

12. (Currently Amended) A method of controlling a data I/O system which includes:

a plurality of storage devices;

a read/write unit, responsive to the subsequent receipt of a read request and a write request, for reading data stored in said storage devices and writing data in said storage devices; and

a logical volume management unit configured to map between a logical image of the data storage of a host processor (logical volume) and an actual space in said storage devices;

said method comprising:

managing an active primary production volume (PVOL) and a secondary mirror volume (S-VOL) group including multiple S-VOLs created as mirror images of said primary volume; [[and]]

restoring the data of a first S-VOL belonging to the S-VOL group with the data of a second S-VOL belonging to the S-VOL group depending on the type of an error that happens in the first S-VOL;

rendering at least one of said S-VOLs belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL and rendering at least one of said S-VOLs belonging to an S-VOL group read-and-writable as at least one Read-and-Writable (RW) S-VOL;

storing updates that have occurred in a Read-and-Writable (RW) S-VOL since a P-VOL and the RW S-VOL were separated in an increments-volume; and

recovering a RW S-VOL belonging to the S-VOL group by replacing the SW S-VOL with the at least one Read-only (RO) S-VOL that has been updated by data of the increments-volume of the RW S-VOL as an error happens in the RW S-VOL.

13. (Currently Amended) A method according to claim 12, further comprising:

~~rendering at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL,~~

recovering an S-VOL belonging to the S-VOL group by copying data of the at least one Read-only (RO) S-VOL to said S-VOL as an error happens in said S-VOL.

14. (Currently Amended) A method according to claim 12, further comprising:

~~rendering at least one of said S-VOLS read-only,~~

recovering an S-VOL where a drive error has happened by replacing the S-VOL with said at least one RO S-VOL.

15. (Currently Amended) A method according to claim 12, further comprising:

~~rendering at least one of said S-VOLs belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL; and~~

monitoring frequencies of accesses to said at least one Read-only (RO) S-VOL,

restoring the data of an S-VOL belonging to the S-VOL group by copying the data of said at least one RO S-VOL with the lowest access frequency as an error happens in said S-VOL.

16. (Currently Amended) A method according to claim 12, further comprising:

~~rendering at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL; and~~

monitoring frequencies of accesses to the at least one Read-only (RO) S-VOL,

recovering an S-VOL belonging to the S-VOL group by replacing the S-VOL with [[a]] the at least one RO S-VOL with the lowest access frequency as an error happens in said S-VOL.

17. (Canceled)

18. (Currently amended) A method according to claim 12, further comprising:

~~rendering at least one of said S-VOLS belonging to an S-VOL group read-only as at least one Read-only (RO) S-VOL and rendering at least one of said S-VOLS belonging to the S-VOL group read-and-writable;~~

monitoring frequencies accesses to the at least one Read-only (RO) S-VOL; and

~~storing updates that have occurred in a RW S-VOL since a P-VOL and the RW S-VOL were separated in [[an]] the increments-volume;~~

recovering a RW S-VOL belonging to the S-VOL group by replacing the RW S-VOL with the at least one RO S-VOL with the lowest access frequency that has updated by data of the increments-volume of the RW S-VOL as an error happens in the RW S-VOL.

19. (Currently Amended) A method according to claim 18, further comprising:

managing a spare S-VOL created as a mirror image of a S-VOL belonging to the S-VOL group and to which read/write accesses are forbidden, recovering the S-VOL where an error has happened by using said spare S-VOL instead of said at least one RO S-VOL.

Reasons for Allowance

4. The following is an examiner's statement of reasons for allowance:

As to independent claims 1 and 12, Ofek et al. (US Patent 5,889,935) and Kamiyama (US Patent 5,893,139) failed to disclose an increments-volume wherein the updates to an RW S-VOL are stored in an increments-volume, and if a failure occurs in the RW S-VOL, the RW S-VOL is restored by updating an RO S-VOL belonging to the same group as the RW S-VOL with the data stored in the increments-volume.

Although Ofek et al. disclosed a cache 28 to store the update data in the R1-VOL and R2-VOL but Ofek et al. failed to disclose if a failure occurs in the R1-VOL, the R1-VOL is recovered by replacing the R1-VOL with the Read-only S-VOL that has been updated by data of the increments-volume of the R1-VOL.

In light of foregoing, claims 1 and 12 are allowable. Claims 2-5 and 7-11 are depending from claim 1 and claims 13-16 and 18-20 are depending from claim 12 therefore the dependent claims are also allowable.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh D. Vo whose telephone number is (571) 272-0708. The examiner can normally be reached on M-F 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Reginald G. Bragdon can be reached on (571) 272-4204. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Thanh D. Vo
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AU: 2189
6/09/2006

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PRIMARY EXAMINER